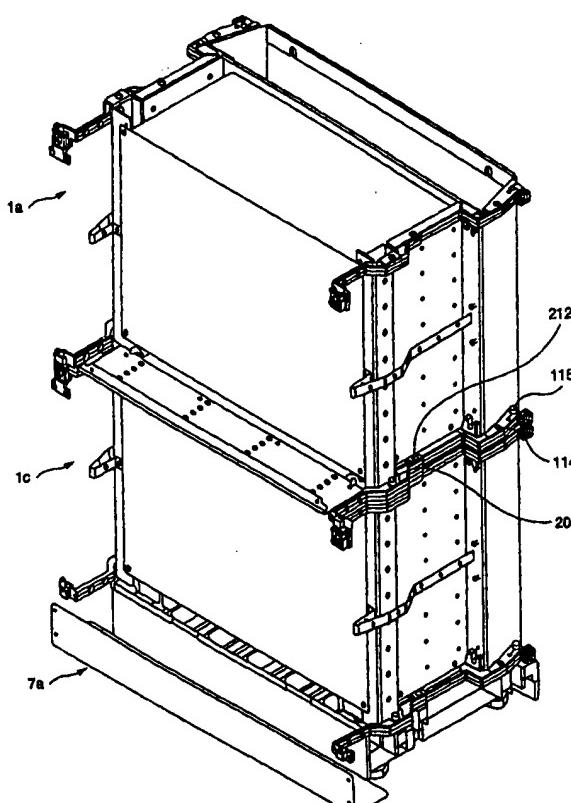


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(71) Applicant (for all designated States except US):	TELEFON- AKTIEBOLAGET LM ERICSSON (publ) [SE/SE]; S-126 25 Stockholm (SE).		(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, GM, GW, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).
(72) Inventors; and			
(75) Inventors/Applicants (for US only):	LÖÖW, Per, Roland [SE/SE]; Lövlundsvägen 1 B, S-149 30 Nynäshamn (SE). NYGREEN, Lars [SE/SE]; Korpvägen 54, S-147 34 Tumba (SE). ANDERSSON, Gunnar [SE/SE]; Musserongången 109, S-135 34 Tyresö (SE). JOHANNISON, Göte [SE/SE]; Lärkstigen 1, S-144 42 Rönninge (SE). BERTILSSON, Lars [SE/SE]; Råggatan 4, 4 tr., S-118 59 Stockholm (SE).		
(74) Agent:	ERICSSON TELECOM AB; IPR Management & Patent Dept., S-126 25 Stockholm (SE).		
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<b>(54) Title:</b> JOINT AND A STACKABLE MODULE FOR ELECTRONIC EQUIPMENT			
<b>(57) Abstract</b>			
The present invention relates to a joint for mounting together two plates (21, 22, 23) on two different stackable modules for electronic equipment, which plates (21, 22, 23) each have at least one flange (110, 111, 112, 113, 206, 207, 210, 211, 214, 215). According to the invention the joint comprises two straps, at least one flange (110, 111, 112, 113, 206, 207, 210, 211, 214, 215) from each plate arranged between the straps (24, 25, 26, 27), and at least one screw which holds together the straps (24, 25, 26, 27) and the plates (21, 22, 23).			
			

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**JOINT AND A STACKABLE MODULE FOR ELECTRONIC EQUIPMENT****TECHNICAL FIELD**

The present invention relates to a joint for joining together modules in a modular construction system for equipped data-, telecommunication- or radio base stations.

**STATE OF THE ART**

In the British patent GB 2 235 826 a stackable module is shown. The module has a top plate, a bottom plate, two side plates and a back plate removably connected with each other by respective mounting connectors. Furthermore, the module has a "door" with a cavity. Several modules can be mounted together by screwing them together with respective flanges on the underside. In the patent documents DE 3 334 587 and EP 0 498 790 similar modules are shown.

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In order to improve cooling it is known, as mentioned in the patent document US 5 398 159, to fit an intermediate wall into the module in order to form a chimney right at the back for air throughflow.

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It is also previously known to form mounting bases for stacks of modules by bending and welding a mounting base made of steel.

**DISCLOSURE OF THE INVENTION**

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The problem with stacks of modules according to the prior art is that cable pulling is not especially flexible and that the cables risk being damaged by the sharp edges on the flanges existing there. The stacks of modules are hardly able to withstand powerful shaking such as occurs during an earthquake.

One object of the present invention is to provide a stable module with the possibility to make a strong joint between several modules so that a stack of modules will be able to stand up to the earthquake requirement even with high weights in the modules.

5

Another object of the present invention is to make modules where the cables can be drawn in a simple and flexible way.

10

A further object of the present invention is to provide a strong joint between the modules which can withstand an earthquake and which is not in the way for equipment, which does not damage any possible cabling and which gives electrically good characteristics between the modules.

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Yet another object of the present invention is to provide a mounting base for cabinets and stacks of modules which is light, simple and cheap to manufacture but even so resistant enough to successfully fulfil the applicable earthquake requirements.

20

The problem can be solved and the objects achieved with a module comprising an outer back plate, two side plates and a door, where the side plates are bent between the outer back plate and the door to uprights in order to increase the stability of the module and so that when two modules are placed beside each other, a vertical cavity is formed between the modules.

25

In this cavity the cabling can take place. Since the cavity between the modules is open at the front nearest to the doors of the modules, the cabling does not have to be threaded; instead the whole bunch of cables can be prefabricated and mounted in the cavities. Cables can also be placed in a cable shelf in front of the modules, in a cable chute in the mounting base or threaded between modules which are standing back to back.

30

The module also comprises an inner back plate mounted so that a cavity is formed between the inner back plate and the outer back plate. This cavity can be used as a "chimney" for the ventilation of throughflowing cooling air.

5 Several modules can be mounted onto each other by a joint between the side plates/uprights, which joint comprises two straps with at least one flange from each side plate between them, and at least one screw which holds together the straps and the plates. The joint is advantageously attached on the outer side of the module in order to not be in the way for a possible equipment. The flanges are arranged  
10 between the straps so that the outer edges of the flanges in relation to the straps are hidden during mounting in order not to damage the cabling. The straps have a shape which preferably follows the side plates but which is longer than the side plates so that if the door is mounted on the outer ends of the straps, a cavity is formed between the door and the side plates for cable pulling.

15

The mounting base can be cast in aluminium in one piece and comprises in the main outer walls, a floor, intermediate walls on both sides of the floor, casting holes in the floor between certain intermediate walls, and mounting holes in the floor and in the outer walls. Furthermore, the mounting base can comprise a cable chute.

20

In the floor nearest to the mounting holes there are no casting holes. The intermediate walls nearest to the mounting holes are placed in crossing direction on the two sides of the floor. Some of the intermediate walls start from the mounting holes in the outer walls. These steps are taken in order that the floor will be able to withstand  
25 the load which is highest at the mounting holes.

One advantage of the present invention is that as the holes run through the whole of the stack of modules, free building-in of electronic units in the whole of the stack of modules is possible, which therefore can be compared to a cabinet.

30

Another advantage is the flexible way of cabling. There is a free vertical cable space through the whole of the stack of modules which is easily accessible from the front even after equipping with electronics. Furthermore, the cables can be laid horizontally in front of the modules and between modules mounted back to back. Bunches 5 of cables can be prefabricated since the cabling paths are made so that the cables do not have to be threaded.

A third advantage is that the modules are stable and the joints between the modules are strong. This means that a stack of modules passes the earthquake requirement 10 even with high weights in the modules.

Further advantages of the joints are that the joints also offer good electrical characteristics between the modules, that there are hidden clipping surfaces in the joints between the modules, which protect the cables, that there are few constituent details 15 and that the joining techniques permit joining together of both equipped and un-equipped modules.

The advantages of the design of the mounting base is that it is economical to cast the base, that aluminium gives a low weight and can be recycled, that the mounting base 20 does not warp during casting, and, last but not least, that the mounting base is resistant and successfully passes the earthquake requirement.

Finally, from a general point of view, there are advantages in that the constructions are economical with few constituent parts, rational manufacturing/ mounting and 25 simple installation work.

The invention will now be described more closely with the help of preferred embodiments and with reference to the accompanying drawings.

## DESCRIPTION OF THE FIGURES

Figure 1 shows a perspective view of the parts which are comprised in a module according to the invention.

5 Figure 2 shows a perspective view of four mounted together modules.

Figure 3 shows a perspective view of the cabinet chassis in a module.

Figure 4a shows a perspective view of a mounting base according to the invention.

Figure 4b shows a view from below, a lateral view and a view from above of the mounting base in Figure 4a.

10 Figures 5a and 5b show a perspective view of the mounting of one module on another.

Figure 6 shows a front view, a lateral view and a view from above of the ventilation in a stack of modules.

Figures 7a-g show how cabling can be arranged in a stack of modules.

15

## PREFERRED EMBODIMENTS

### In general

20 Figure 1 shows the different parts of a module 1 according to the invention and Figure 2 shows four mounted together modules 1a, 1b, 1c, 1d.

A module 1 comprises a cabinet chassis 2 and a door 3, and, if required, one or two side cover plates 4, 5, a cover plate 6 and a cable shelf 12. The modules 1c, 1d,  
25 which are mounted closest to the floor, are mounted on a mounting base 7, 7a, 7b, with a cable chute 8 and a rear base cover 9, and optionally one or two base side cover plates 10, 11.

In the case of two modules 1a, 1b mounted beside each other in the lateral direction, two cover strips 13 can also be used on the rear side, if it is not desired to thread cables that way.

5      **The appearance of the cabinet chassis**

In Figure 3 the cabinet chassis 2 can be studied in more detail. The cabinet chassis 2 comprises an outer back plate 21, two uprights 22, 23, four straps 24, 25, 26, 27, and optionally two cable holders 28, 29, and an inner back plate 30. The inner back plate  
10     30 is shown in Figure 1.

The outer back plate 21 is bent to form a back surface 101, two side surfaces 102, 103, and two mounting surfaces 104,105. The angles between the surfaces are not right angles. This is to make the cabinet chassis compatible with earlier existing  
15     cabinets in respect of a possible mounting together, and also to increase the stability.

The back surface 101 is provided with four holes 106 for mounting. The mounting holes 106 can be used when two modules are to be mounted back to back. Seen strictly, it is sufficient with the two uppermost mounting holes 106 for sufficient  
20     strength. It is also possible to use the mounting holes 106 for mounting a stack of modules against a wall. Otherwise, mounting against walls can take place with the help of angle brackets mounted in holes on the upper side of the stack of modules.

The upper and lower edges 107, 108 of the back surface are bent to a double thickness with notches 109 for the mounting holes 106. This is to avoid sharp edges, and  
25     for reinforcing.

The upper and lower edges 110, 111, 112, 113 of the side surfaces are bent to right angles in order to form flanges 110, 111, 112, 113 for mounting. Each flange 110,  
30     111, 112, 113 is provided with a hole 114, a notch 115 and a snap shoulder 118,

which are used for mounting together of two modules in the vertical direction in order to form a stack of modules.

Each mounting surface 104, 105 is provided with a row of holes 116 for mounting the inner back plate 30, preferably according to the standard for equipment. Each mounting surface 104, 105 is also provided with two holes 117 for mounting together of the outer back plate 21, an upright 22, 23 and a strap 24, 25, 26, 27, and two holes 120 for mounting a contact bar between two modules. Furthermore, each mounting surface 104, 105 is provided with a hole 121 for the cable holder 28, 29, and two holes 119 for simple mounting together of the outer back plate 21 with the uprights 22, 23. The mounting surface can furthermore be provided with extra holes for mounting external earth cables.

Each upright 22, 23 is bent to form a first equipment surface 201, a first mounting surface 202, an intermediate surface 203, a second equipment surface 204 and a second mounting surface 205.

The first equipment surface 201 is provided with corresponding standardized holes 116 such as the equipment surface 105 of the outer back plate could have, and mounting holes 218 for the cable holder 29.

The edges 206, 207 of the first mounting surface 202 are bent to form flanges 206, 207, each with a mounting hole 208 which is used for mounting together two modules vertically. Furthermore, the first mounting surface 202 comprises two further mounting holes 209 for mounting together the uprights 22, 23 with the straps 24, 25, 26, 27, and mounting holes 217 for cables.

The second equipment surface 204 has in the same way edges 210, 211, which are bent to form flanges 210, 211, each with a mounting hole 212. The second equipment surface 204 is furthermore equipped with standardized holes 213 for mounting

of bars for the equipment. The second equipment surface can, furthermore, be provided with mounting holes 219 for an optional angle bracket which can be fastened between the uprights 22,23 and the mounting base 7 for increased protection during earthquakes.

5

The edges 214, 215 of the second mounting surface are also bent to form flanges 214, 215, but can be without mounting holes. The second mounting surface 205 is on the other hand provided with mounting holes 117, 120 and 121, corresponding to the mounting holes 117, 120, 121 on the mounting surface 105 of the outer back plate 21. The mounting surface 105 of the outer back plate is, however, wider than the second mounting surface 205 of the upright, which means that when the outer back plate 21 and the upright 22, 23 are mounted together according to Figure 3, the equipment holes 116 of the outer back plate will be accessible for mounting of the inner back-plate 30.

10  
15

The straps 24, 25, 26, 27 are mounted on the inside of the flanges 206, 210, 214, 112 and have a shape which follows the uprights 22,23 and the outer back plate 21. Each strap 24, 25, 26, 27 has in the same way mounting holes 209 corresponding to the mounting holes 209 in the first mounting surface of the uprights, and mounting holes 208, 212, 114, 118 and 115 in accordance with corresponding holes, shoulders and notches 208, 202, 114, 118 and 115 on the flanges 206, 210, 214, 112.

20  
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It can, however, be noted that the rearmost mounting hole 115 is a hole on the upper straps 24, 26, but a notch on the lower straps 25, 27. This is in order to simplify mounting of one module above another or on top of a mounting base. The mounting can in this case simply take place by a screw being screwed a small distance into the mounting hole 115 on the lower module/mounting base, whereafter the upper module is pushed in place. The notch 115 on the upper flanges 112 on the outer back plate could naturally also be a hole instead of a notch, but here it has been chosen to make the outer back plate 21 symmetrical in order to speed up assembly.

Furthermore, each strap 24, 25, 26, 27 has an outgrowth 216 with a notch 117, which corresponds to the hole 117 in the second mounting surface of the upright and the hole 117 in the mounting surface 105 of the outer back plate. This construction is in order to mount together the upright 22, 23 with the outer back plate 21 but also helps to provide a strong and stable joint when two modules are joined together.

Each strap 24, 25, 26, 27 has, as mentioned, a shape which follows the uprights 22, 23 and the outer back plate 21, but the straps 24, 25, 26, 27 are longer and extend out a bit in front of the cabinet chassis 2. This is in order to form a space for cables, in accordance with the standards.

At the very front of the straps 24, 25, 26, 27 the door 3 is fastened. The lower straps 25, 27 have notches 220 for hooking on of corresponding bosses on the door 3, while the upper straps 24, 26 have holes 221 and clips 222 for screwing the corresponding screws on the door 3.

Furthermore, at the very front of each strap 24, 25, 26, 27 there are holes 223 for the mounting of possible side cover plates 4, 5. On the upper left strap 24 holes 224 can be placed for mounting a cabinet-identifier, and on the lower left 25 or the right 27 strap a hole 225 can be placed for a wrist strap.

The door 3 as well as the cover plate 6 and the cable shelf 12 have ventilation holes 252, 253, 254, which can be seen in Figure 1.

25 The cable shelf 12 and the cable holder 28, 29 have furthermore holes 251, 255 for cable mounting.

**The appearance of the mounting base**

Figures 4a and 4b show the mounting base 7 in more detail. It is cast in aluminium in one piece. The mounting base 7 is, however, not made of a solid block. This is in order to save material and to make it lighter. Aluminium can, as is known, also be recycled. The mounting base 7 is provided with a floor 300 surrounded by outer walls 307. In the floor 300 there are four floor mounting holes 301 and eight holes 302 for the mounting of four or eight feet. In the vicinity of the outer walls 307 there are six holes 303 for the mounting of a possible attachment bracket, and eight mounting holes 208, 212, 114, 115, which correspond to the mounting holes 208, 212, 114, 115 on the cabinet chassis 2.

To prevent the mounting base 7 from warping during the casting there are furthermore twelve casting holes 304 in the floor 300. These casting holes 304 also allow air to be taken in from below, which sometimes can be desired. If it is not desirable that air is taken in from below, e.g. from the fire-protection point of view, a protective plate can be placed over the casting holes.

In order to make the mounting base 7 light but still stable, a number of intermediate walls 305 are provided. Their positioning and number depend on casting requirements and durability demands. An example is shown in Figure 4b but other variations can be envisaged. The appearance should, however, be somewhat symmetrical at the same time as there should be intermediate walls/outer walls near to the mounting holes 208, 212, 114, 115, 301, 302, 303 for the sake of stability.

In the example in Figure 4b the intermediate walls nearest to the mounting holes 208, 212, 114, 115, 301, 303 are placed in a cross on the upper and undersides of the mounting base. Furthermore, there are no casting holes 304 in this region. These actions are taken in order to increase the durability since the largest loads occur at said mounting holes 208, 212, 114, 115, 301, 302, 303.

As mentioned earlier, the mounting base 7 comprises also a cable chute 8 and a rear mounting base cover 9, and optionally one or two mounting base side cover plates 10, 11. The rear mounting base cover is screwed in holes in the rear side of the mounting base 7. The cable chute 8 is hooked in notches 306 on the mounting base in order that the upper side of the mounting base should be even. The mounting base side cover plates 10, 11 are screwed in the front of the cable chute 8 but are snapped to the rear of the mounting base in notches 308 in order to facilitate demounting when a stack of cabinets stands up against a wall.

10      **Short complementary text about mounting and earthing**

In order to mount the stack of modules, a mounting base is first screwed in the floor with four screws, preferably expander screws, in the four floor mounting holes so that the mounting base is horizontal.

15      If several module stacks are to be mounted laterally, the mounting bases are mounted at a suitable distance from each other by using contact bars between the mounting bases, which contact bars are attached with screws in the mounting holes 208,115. These contact bars can then be taken away after the mounting bases have  
20      been mounted in place.

A first module is mounted on the mounting base by two screws at the front and two screws at the back being mounted in the mounting holes 208,115. Suitably, as mentioned earlier, the first screws can be screwed in a bit in the rear mounting holes  
25      115, whereafter the module is pushed in place and the rest of screws are screwed in.

A second module is mounted in the same way on the first module by, in the same way two screws at the front and two screws at the back being mounted in the mounting holes 208,115. In this way the stack of cabinets is built up to the desired  
30      height, suitably, however, at most five modules.

The stack of cabinets, which must be able to survive an earthquake, is suitably reinforced with four extra screws between the mounting base and the first module in the mounting holes 212,114, and four extra screws between the first module and the second module, similarly in the mounting holes 212,114.

5

When unequipped modules are to be mounted on each other, suitably a mounting bar is used in order to get everything aligned.

10

Thus, two modules are joined together by the flanges from each module being pressed together by two powerful straps on each side by mounting screws through corresponding holes in the flanges and the straps, see Figure 5, with the same numerals as in earlier Figures. This, in combination with the mounting of the straps to the uprights, as mentioned earlier, gives a strong and stable joint which can successfully pass the earthquake requirement even with relatively high weights in the modules. Since the clipping surfaces are hidden, the cabling is also protected (see below).

15

The flanges and the straps could equally well be mounted on the inside of the modules but as they are, as in the Figures, mounted on the outside of the modules, a stack of modules has a "running" space which can be compared to a cabinet. This means that a free building-in of electronic units can be obtained in the whole of the stack of modules.

20

The joint also offers good electrical conductor characteristics between the modules, which is important from an earthing point of view. An external earth cable is suitably connected to one of the screws which joint together the upper module and the next upper module, and in this way the whole of the stack of modules becomes earthed.

A contact bar should be mounted between two modules which stand beside each other in the lateral direction. This is above all for the sake of electrical conduction, but to a certain amount also for the sake of stability.

- 5      The mounting base 7 is only used at the lowest part of a stack of modules, the cover plate 6 in the same way only on the uppermost, while the side cover plates 4,5 and the mounting base side cover plates 10,11 are only used on the sides of the module where there will not be mounted any other module, see Figure 2. If two modules are mounted side-to-side, then, as mentioned earlier, cover strips 13 can instead be  
10     attached on the rear side.

A stack of modules can also be attached to a wall or with two stacks of modules back to back.

15     **Ventilation**

Both natural convection and forced ventilation, parallel and serial ventilation can be handled in the stack of modules. Figure 6 shows the general principle for forced parallel ventilation.

- 20     Since a magazine 45 is mounted at a certain distance from the outer back plate 21 of the module, a channel 46, which will act as a chimney 46 for cooling air, is formed. The cable shelf 12 functions also as an air-guiding plate and controls the airflow.
- 25     The cooling air comes in from the front of the module through the ventilation holes 252 of the doors and goes out through the ventilation holes 253 of the cover plate at the top of the stack of modules. Each module has a separate intake for air at room temperature. The advantages of parallel ventilation is that it is independent of the equipment of the magazines in a stack of modules, higher heat loads can be

accepted in the magazines, and that a good protection against fire is obtained, in that the fire cannot spread from one magazine to another.

Serial ventilation, on the other hand, means that the same air passes through all the  
5 modules in a stack of modules, from the mounting base 7 to the cover plate 6. This means that the air temperature will rise as the air passes the modules. On the other side, the modules can be equipped more because no air intake is required under each magazine.

- 10 In particular for air-cooled configurations an inner back plate 30 can be mounted a distance from the outer back plate 21 to ensure that a pressure increase in the chimney 46 cannot cause the warmed-up air to be forced in over or under the equipment in the wrong manner. The appearance of the inner back plate 30 depends on the equipment of the module and should be specially designed. In particular, if a fan  
15 44 is to be used, the inner back plate 30, however, should be provided with at least one hole.

Naturally it is possible to combine different ventilation methods, if so desired.

20 **Cabling**

Figure 2 shows four mounted together modules 1a, 1b, 1c, 1d on two mounting bases 7a, 7b. If a module 1a is to be mounted next to another module 1b, as mentioned earlier, no side cover plates 4, 5 or mounting base side cover plates 10,  
25 11 are mounted between the modules 1a, 1b.

Because of the bent side walls 22, 23 of the cabinet chassis 2, vertical cable shafts 41, 42, 43 are formed between the modules and between the modules and the side cover plates 4, 5. As the straps 26, 24 between the modules 1a, 1b do not meet at the front edge, see Figure 7g, but leave an opening of approximately 2 cm, cabling can

occur without the cables needing to be threaded. This means that the bunches of cables can be prefabricated and mounted directly.

In Figure 7 the cabling can be seen more clearly. In order to lay cables in the cable shaft 41, 42, 43, the cable holders 28, 29 can advantageously be used. The cable(s) are strapped sufficiently firmly to the front edge of the cable holder, Figure 7b. Thereafter the cable(s) are pushed backwards along the cable holders 28, 29 into the cable shaft 41, 42, 43, Figure 7c. Cables can also be mounted in the mounting holes 255 in the cable holders 28, 29, in the mounting holes 217, in the uprights 22, 23, 10 Figure 7f, or against the straps 24, 25, 26, 27, Figure 7d.

Moreover, cables can be mounted in the mounting holes 251 in the cable shelf 12, Figure 7e, and laid in the cable chute 8 of the mounting base. If two stacks of modules are mounted with their backs towards each other, it is possible to leave out the cover strips 13 and instead draw cables that way. All in all, the design of the 15 modules permits cabling in a simple and flexible way.

## CLAIMS

1. Joint for the mounting together of two plates (21, 22, 23) on two different stackable modules for electronic equipment, which plates (21, 22, 23) each have at least one flange (110, 111, 112, 113, 206, 207, 210, 211, 214, 215), **characterized** in that the joint comprises two straps, at least one flange (110, 111, 112, 113, 206, 207, 210, 211, 214, 215) from each plate arranged between the straps (24, 25, 26, 27), and at least one screw which holds together the straps (24, 25, 26, 27) and the plates (21, 22, 23).

10

2. Joint according to Claim 1, **characterized** in that the plates (21, 22, 23) are provided with surface elements formed as uprights and that the straps (24, 25, 26, 27) follow the shape of the plates (21, 22, 23) along the flange/flanges (110, 111, 112, 113, 206, 207, 210, 211, 214, 215) on the plates.

15

3. Joint according to Claim 1 or 2, **characterized** in that the outer edges of the flanges (110, 111, 112, 113, 206, 207, 210, 211, 214, 215) are arranged between the straps (24, 25, 26, 27) so that the outer edges in relation to the straps (24, 25, 26, 27) become hidden during mounting together.

20

4. Stackable module for electronic equipment, comprising a back plate (21), two side plates (22, 23) arranged by the back plate (21), which side plates (22, 23) each have at least one flange (206, 207, 210, 211, 214, 215), and comprising a door (3) arranged by the side plates (22, 23) on the front side of the module, which module is arranged to be able to be mounted on another module in order to together form a stack of modules, **characterized** by a joint which is arranged for vertical mounting together of two side plates (22, 23) on two different modules, which joint comprises two straps (24, 25, 26, 27), at least one flange (206, 207, 210, 211, 214, 215) from each side plate arranged between the straps (24, 25, 26,

27), and at least one screw which holds together the straps (24, 25, 26, 27) and the plates.

5 5. Module according to Claim 4, **characterized** in that the side plates (22, 23) are provided with surface elements (201, 202, 203, 204, 205) shaped as uprights.

10 6. Module according to any of Claims 4 or 5, **characterized** in that the back plate (21) is provided with shaped surface elements (101, 102, 103, 104, 105) and flanges (110, 111, 112, 113).

15 7. Module according to any of Claims 5 or 6, **characterized** in that the straps (24, 25, 26, 27) follow the shape of the surface elements (101, 102, 103, 104, 105, 201, 202, 203, 204, 205) of the side plates and/or the back plates along the flange/flanges (110, 111, 112, 113, 206, 207, 210, 211, 214, 215) on the side plates/back plates.

20 8. Module according to any of Claims 4-7, **characterized** in that the outer edges of the flanges (110, 111, 112, 113, 206, 207, 210, 211, 214, 215) are arranged between the straps (24, 25, 26, 27) so that the outer edges in relation to the straps (24, 25, 26, 27) become hidden during mounting together of the modules.

25 9. Module according to any of Claims 4-8, **characterized** in that the flanges (110, 111, 112, 113, 206, 207, 210, 211, 214, 215) and the straps (24, 25, 26, 27) are placed on the outside of the module.

10. Module according to any of Claims 4-8, **characterized** in that the flanges (110, 111, 112, 113, 206, 207, 210, 211, 214, 215) and the straps (24, 25, 26, 27) are placed on the inside of the module.

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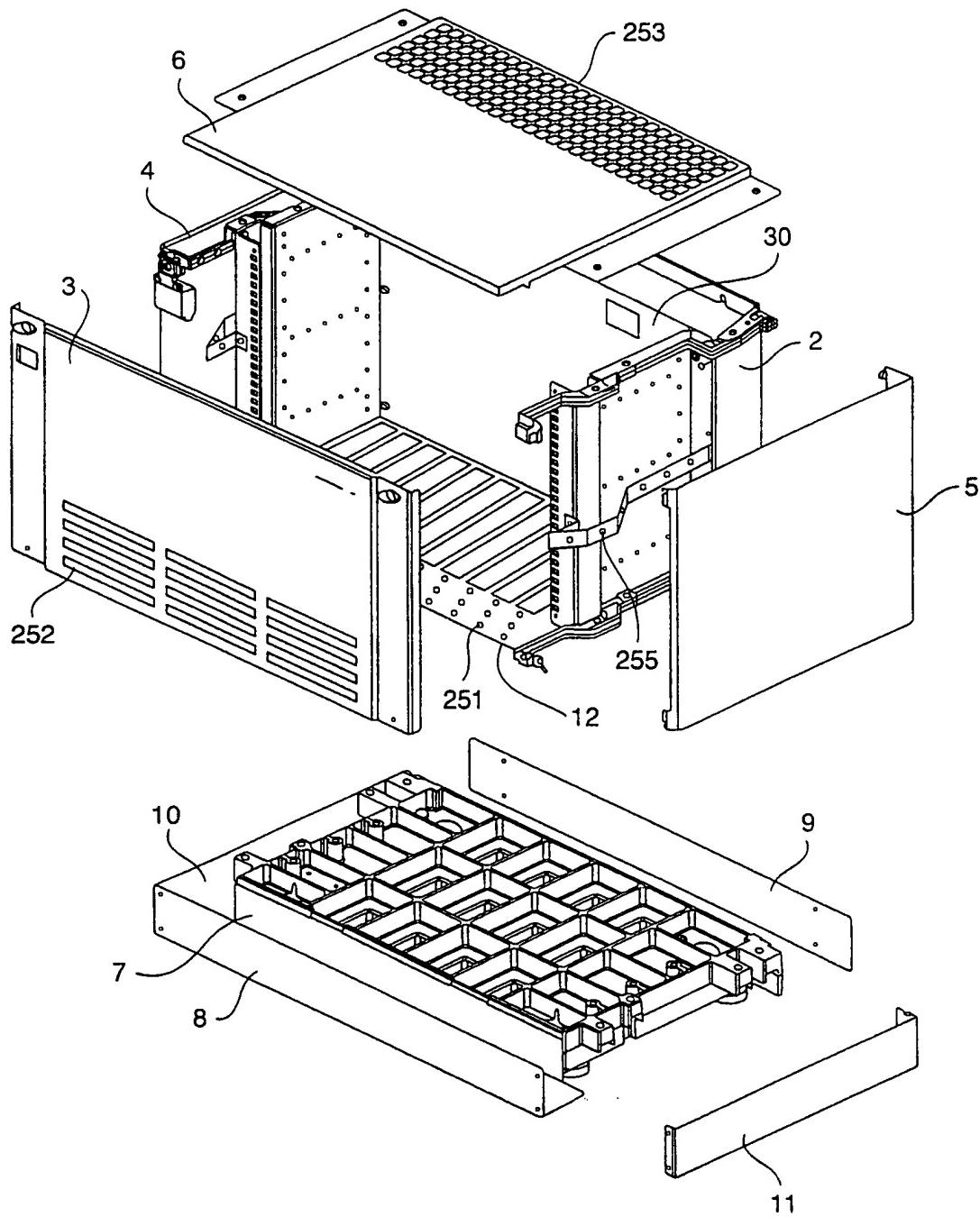


Fig. 1

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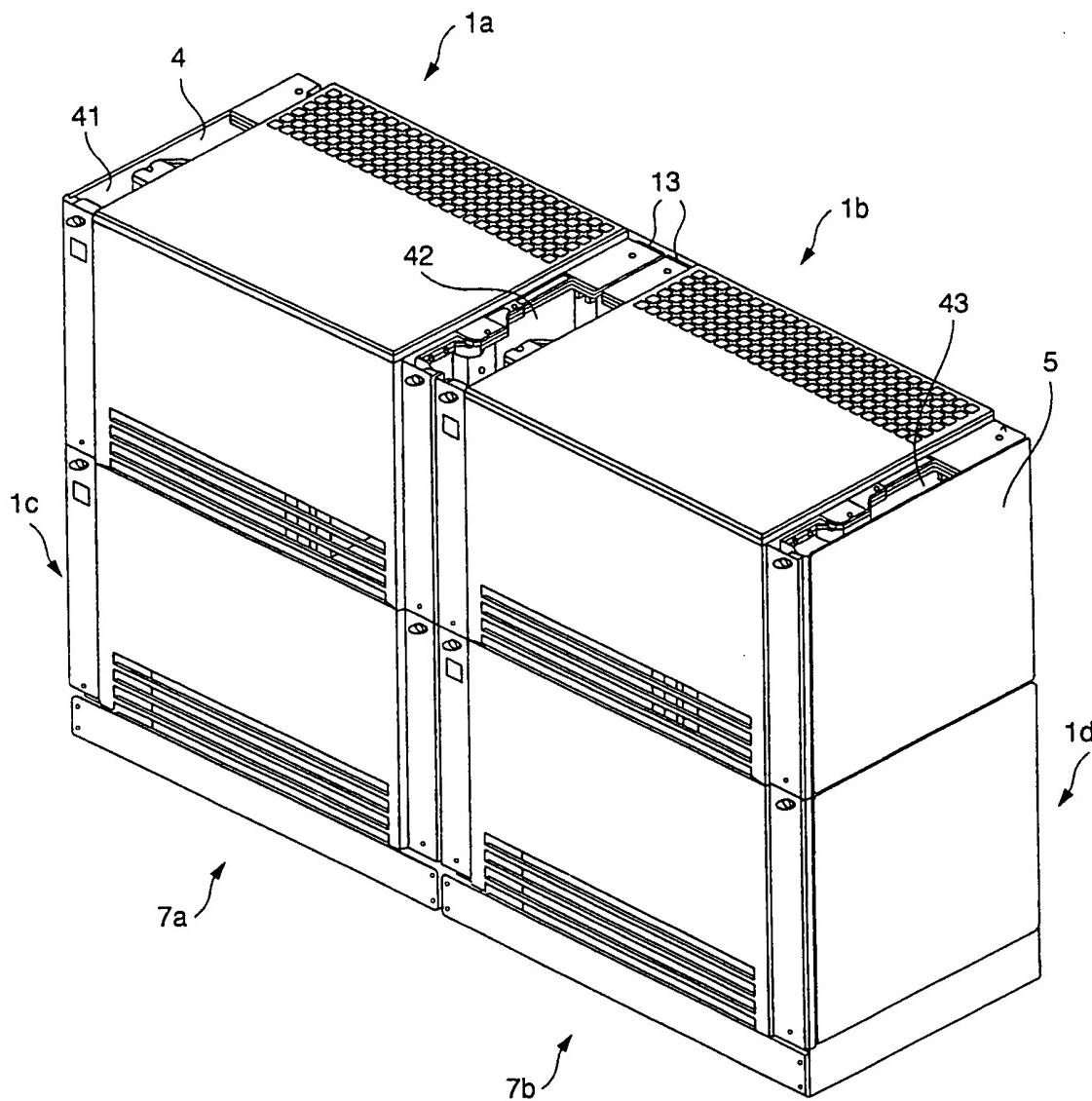


Fig. 2

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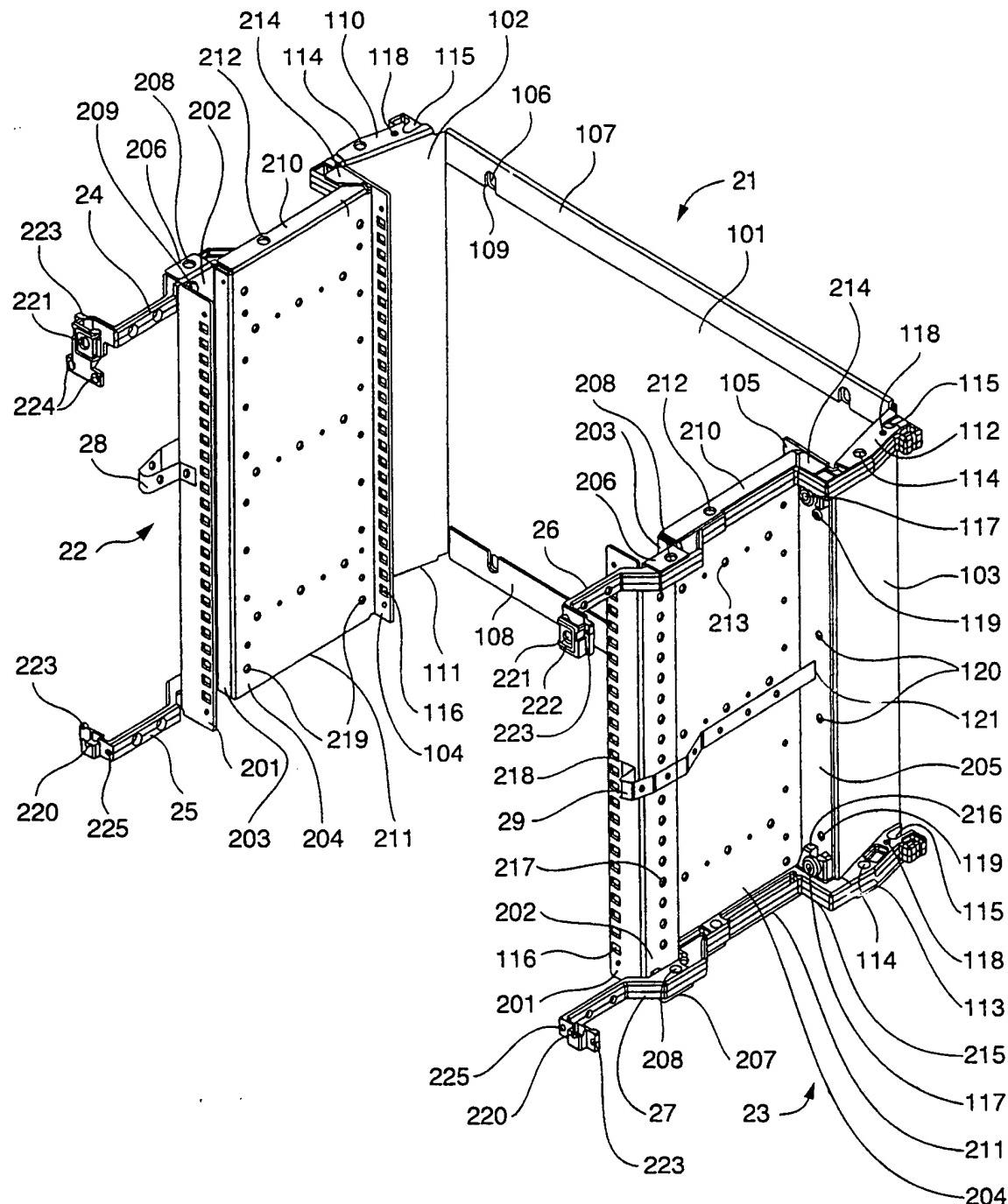


Fig. 3

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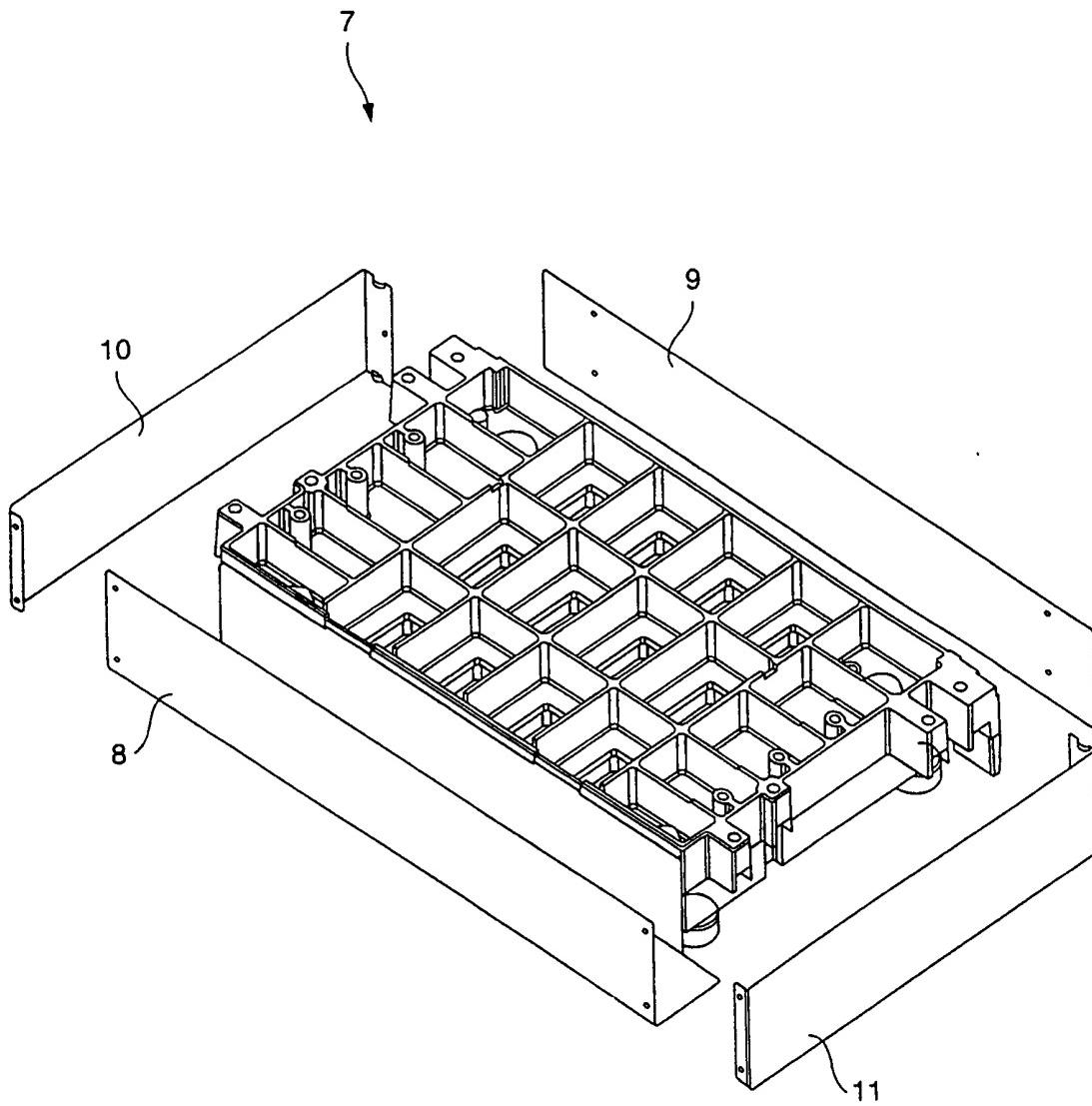


Fig. 4a

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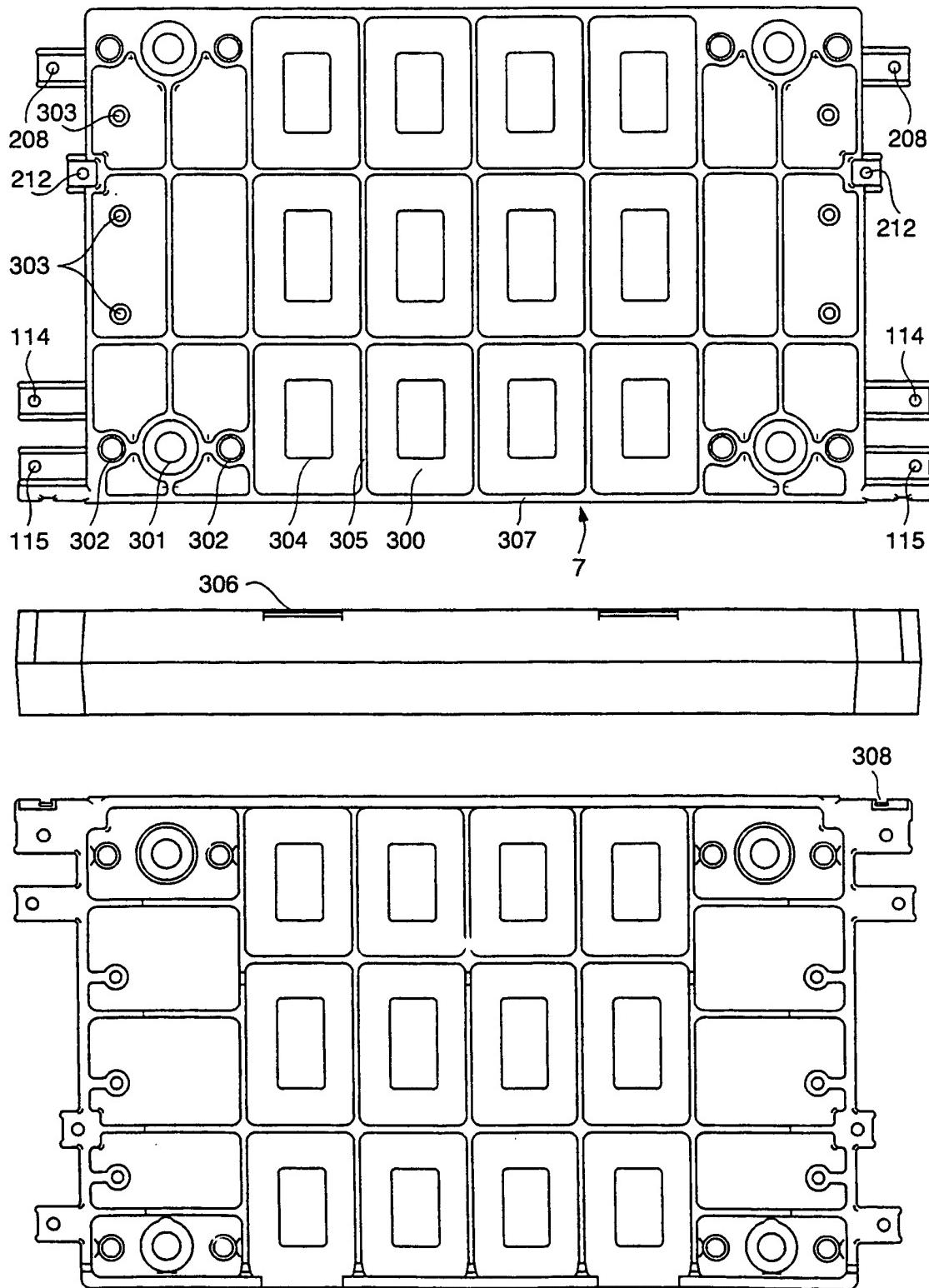


Fig. 4b

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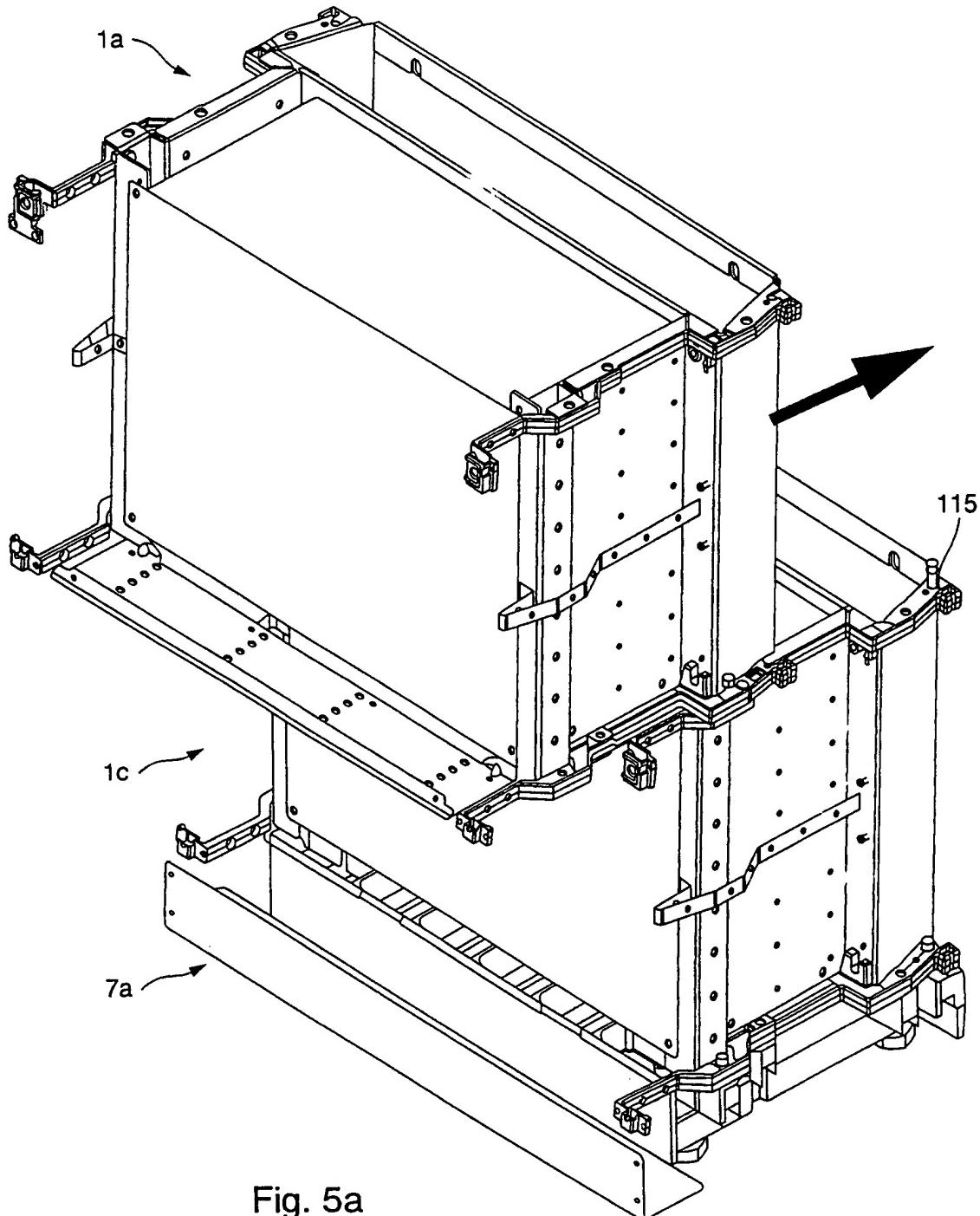


Fig. 5a

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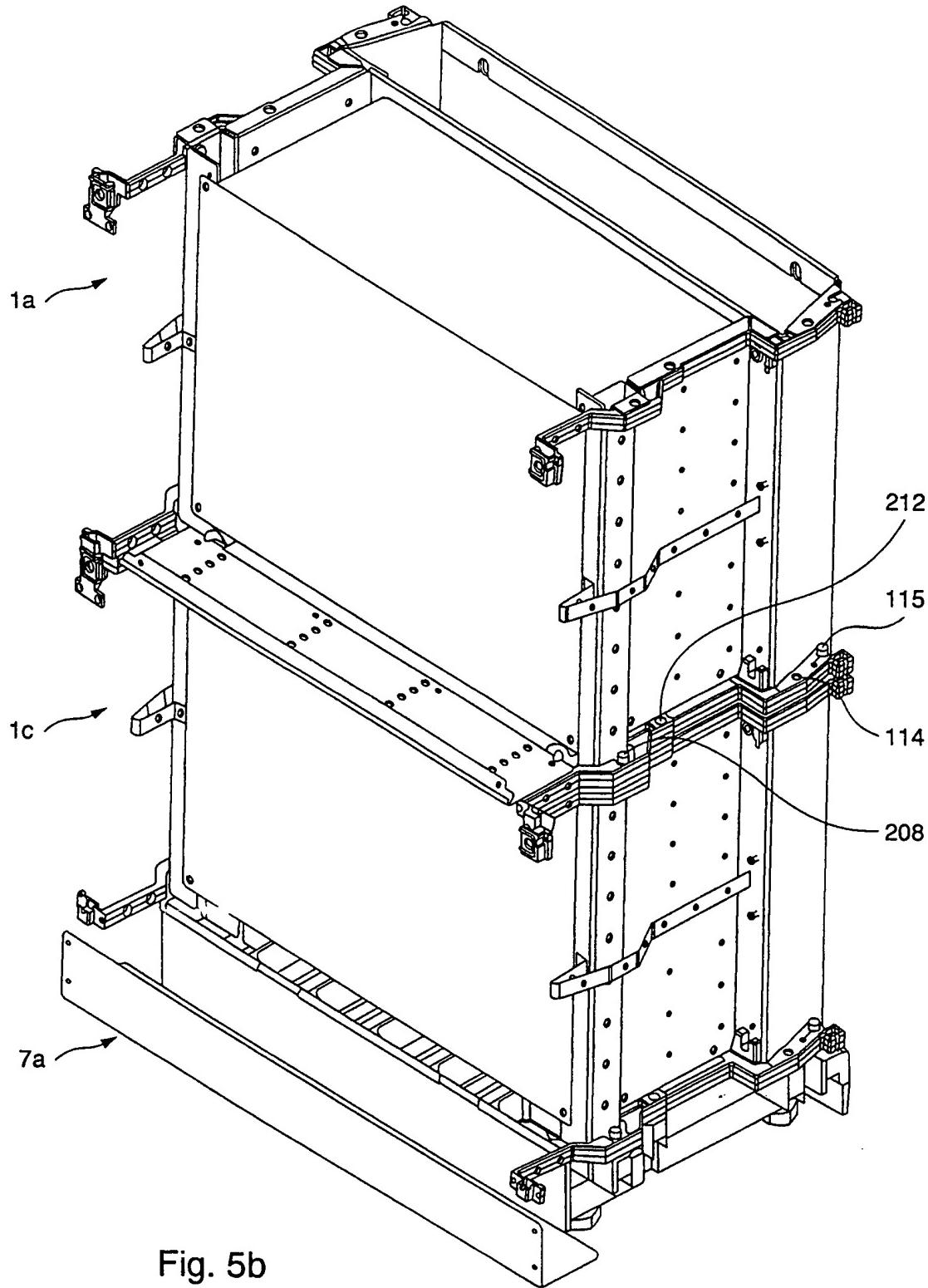


Fig. 5b

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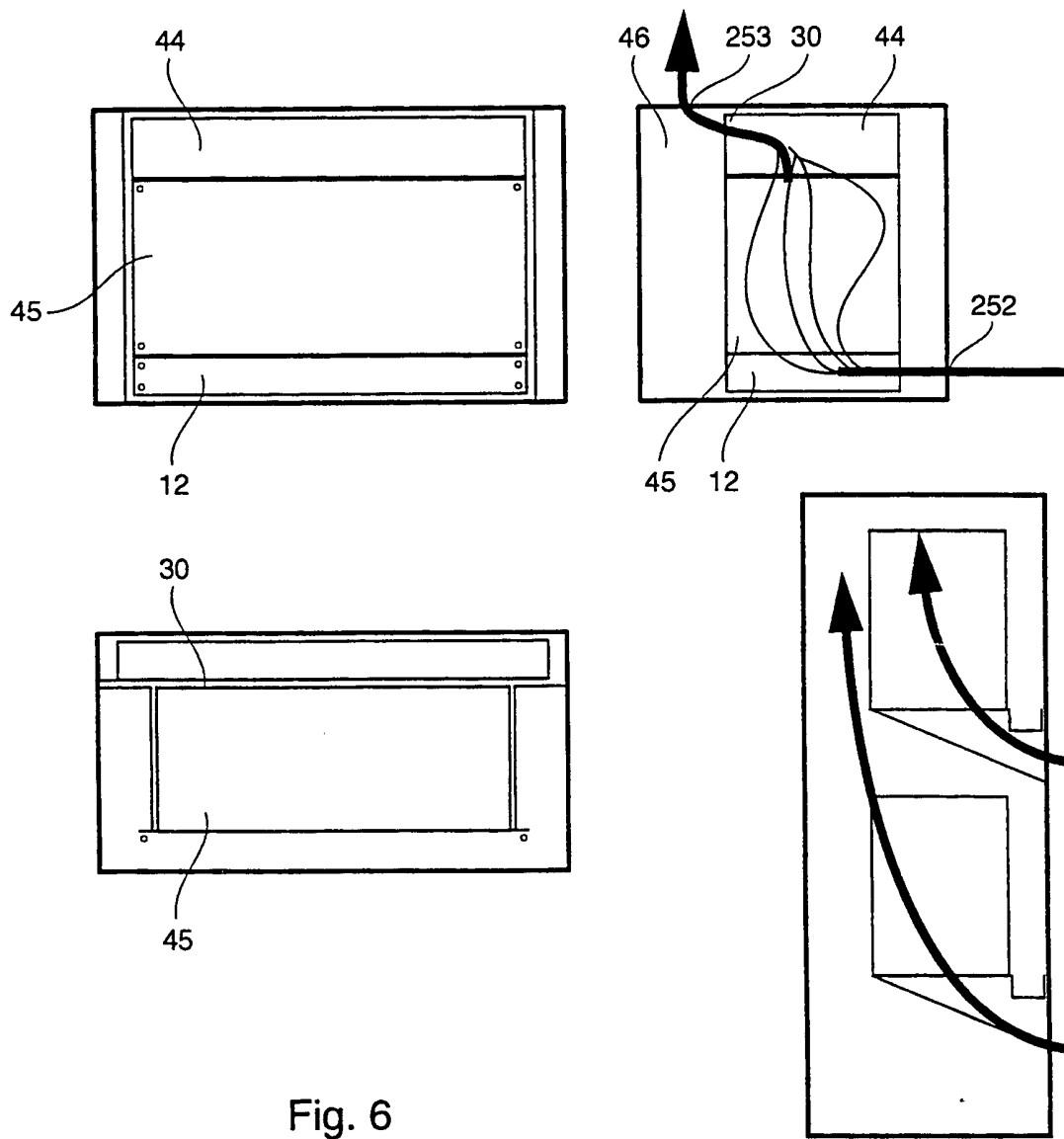
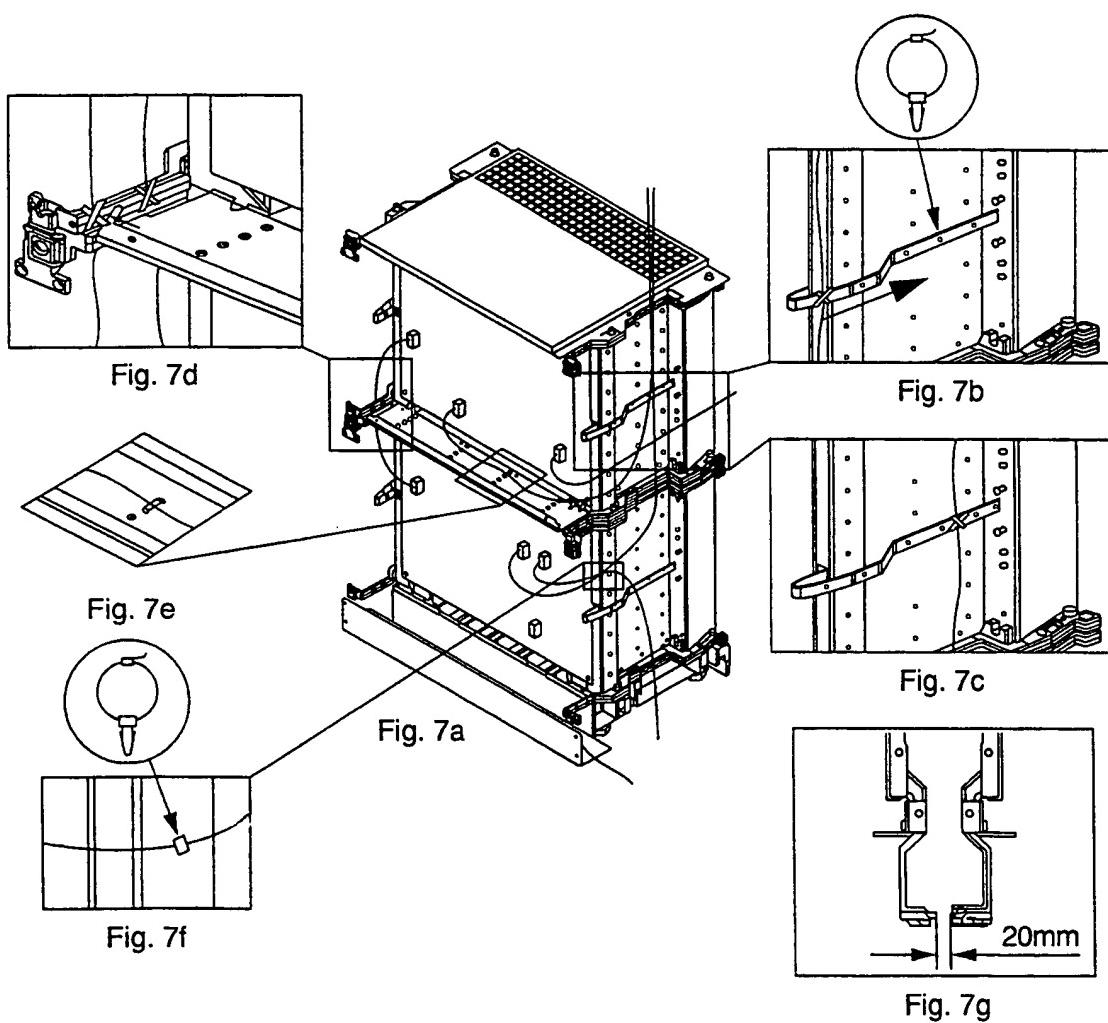


Fig. 6

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# INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 98/00515

## A. CLASSIFICATION OF SUBJECT MATTER

**IPC6: H05K 7/18, H05K 5/04, H02B 1/50**

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

**IPC6: H05K, H02B**

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

**SE,DK,FI,NO classes as above**

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

**WPI**

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4996628 A (R.T. HARVEY ET AL.), 26 February 1991 (26.02.91), figures 3,5, abstract  --	1-10
A	EP 0049517 A2 (SIEMENS AKTIENGESELLSCHAFT), 14 April 1982 (14.04.82), figures 1,2, abstract  --	1-10
A	DE 2538340 B1 (SIEMENS AG), 9 December 1976 (09.12.76), figures 1,3  --	1-10
A	EP 0078405 A2 (BÜNDOPLAST GMBH & CO. KG), 11 May 1983 (11.05.83), figure 1, abstract  --	1-10

Further documents are listed in the continuation of Box C.

See patent family annex.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&" document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search	Date of mailing of the international search report
17 August 1998	17 -08- 1998
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer  Lars Jakobsson Telephone No. +46 8 782 25 00

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## INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 98/00515

## C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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Form PCT/ISA/210 (continuation of second sheet) (July 1992)

**INTERNATIONAL SEARCH REPORT**

Information on patent family members

27/07/98

International application No.

PCT/SE 98/00515

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